

1 WHAT IS CLAIMED IS:

2
3 1. A synchronizer for compulsorily synchronizing a plurality of
4 video players for simultaneous display of as many correlated pictures, each
5 video player being for use with a video storage medium on which there
6 is stored a video signal including a series of vertical sync pulses, the
7 synchronizer comprising:

8 (a) a plurality of vertical sync pulse separator circuits to be con-
9 nected one to each video player for separating a series of
10 vertical sync pulses from a video signal being recovered
11 from a video storage medium;

12 (b) a reference moment determination circuit connected to the vertical
13 sync pulse separator circuits for determination of a refer-
14 ence moment in prescribed time relationship to each vertical
15 sync pulse of one selected series of such pulses being
16 supplied from either of the vertical sync pulse separator
17 circuits; and

18 (c) a play synchronization circuit connected to the vertical sync pulse
19 separator circuits and the reference moment determination
20 circuit for production of a plurality of phase departure
21 signals each indicative of a phase departure, if any, of
22 each vertical sync pulse of one series of such pulses from
23 the reference moment determined in relation to one associat-
24 ed vertical sync pulse of the selected series of such
25 pulses, the phase departure signals being for delivery one
26 to each video player for causing the video players to pro-
27 duce the series of vertical sync pulses in phase with each
28 other.

29
30 2. The video player synchronizer of claim 1 wherein the ref-
31 erence moment determination circuit is adapted to determine the reference
32 moments in prescribed time relationship to the series of vertical sync
33 pulses that is most advanced in phase.

34
35 3. The video player synchronizer of claim 1 wherein the ref-
36 erence moment determination circuit is adapted to determine the reference

1 moments in prescribed time relationship to the series of vertical sync
2 pulses that is most delayed in phase.

3
4 4. The video player synchronizer of claim 1 wherein the video
5 signal contains one vertical sync pulse per field, and wherein the refer-
6 ence moment determination circuit is adapted to determine the reference
7 moment at the trailing edge of each pulse of that series of vertical sync
8 pulses which is most delayed in phase.

9
10 5. The video player synchronizer of claim 1 wherein the play
11 synchronization circuit comprises a plurality of *D* flip-flops each having a
12 clock input connected to one vertical sync pulse separator circuit, a data
13 input connected to a supply terminal, a reset input connected to the ref-
14 erence moment determination circuit, and an output to be connected to
15 one video player for delivery of one phase departure signal thereto.

16
17 6. The video player synchronizer of claim 5 wherein the ref-
18 erence moment determination circuit has inputs connected to the outputs
19 of the flip-flops of the play synchronization circuit for determination of
20 the reference moment in response to outputs therefrom.

21
22 7. The video player synchronizer of claim 1 wherein each vid-
23 eo player has drive means for creating relative scanning motion between
24 the video storage medium and a transducer under the control of a servo
25 signal, and wherein the synchronizer further comprises output means for
26 delivery of one phase departure signal and one servo signal to each vid-
27 eo player.

28
29 8. The video player synchronizer of claim 1 further comprising
30 a status judgment circuit whereby the synchronizer is permitted to syn-
31 chronize the video players only when all the video players are in play
32 mode.

33
34 9. The video player synchronizer of claim 1 further comprising
35 means for permitting the play synchronization circuit to produce the phase
36 departure signals for delivery to only those video players which are in

1 play mode.

2

3 10. A synchronizer for compulsorily synchronizing a first and a
4 second video player for simultaneous display of correlated pictures, each
5 video player being for use with a video storage medium on which there
6 is stored a video signal including a series of vertical sync pulses, the
7 synchronizer comprising:

8 (a) a first vertical sync pulse separator circuit to be connected to a
9 first video player for separating a first series of vertical
10 sync pulses from a first video signal being recovered from
11 a first video storage medium;

12 (b) a second vertical sync pulse separator circuit to be connected to
13 a second video player for separating a second series of
14 vertical sync pulses from a second video signal being re-
15 covered from a second video storage medium;

16 (c) a reference moment determination circuit connected to the first
17 and the second vertical sync pulse separator circuit for
18 determination of a reference moment in prescribed time rela-
19 tionship to each vertical sync pulse of a selected one of
20 the first and the second series of such pulses being sup-
21 plied from the first and the second vertical sync pulse
22 separator circuit; and

23 (d) a play synchronization circuit comprising a first and a second *D*
24 flip-flop having clock inputs connected respectively to the
25 first and the second vertical sync pulse separator circuit,
26 reset inputs connected to the reference moment determina-
27 tion circuit, and data inputs connected to a supply terminal,
28 for production of a first phase departure signal indicative
29 of a phase departure, if any, of each vertical sync pulse
30 of the first series from the reference moment determined in
31 relation to one associated vertical sync pulse of the select-
32 ed series, and a second phase departure signal indicative of
33 a phase departure, if any, of each vertical sync pulse of
34 the second series from the reference moment determined in
35 relation to one associated vertical sync pulse of the select-
36 ed series, the first and the second phase departure signal

1 being for delivery to the first and the second video play-
2 er, respectively, for causing the same to synchronize the
3 first and the second series of vertical sync pulses.
4

5 11. The video player synchronizer of claim 10 wherein the ref-
6 erence moment determination circuit comprises:

- 7 (a) an OR gate having inputs connected respectively to the first and
8 the second vertical sync pulse separator circuit;
9 (b) a NOR gate having inputs connected respectively to the first and
10 the second flip-flop of the play synchronization circuit; and
11 (c) a *D* flip-flop having a clock input connected to the OR gate, a
12 data input connected to the NOR gate, and an output con-
13 nected to the reset inputs of the first and the second
14 flip-flop of the play synchronization circuit.
15

16 12. The video player synchronizer of claim 10 wherein the first
17 and the second video player have drive means for creating relative scan-
18 ning motion between the video storage medium and a transducer under
19 the control of a first and a second servo signal, respectively, and where-
20 in the play synchronization circuit of the synchronizer further comprises:

- 21 (a) a first adder having one input connected to the output of the
22 first flop-flop, another input to be connected to the second
23 video player for inputting the second servo signal, and an
24 output to be connected to the drive means of the second
25 video player; and
26 (b) a second adder having one input connected to the output of the
27 second flip-flop, another input to be connected to the first
28 video player for inputting the first servo signal, and an
29 output to be connected to the drive means of the first
30 video player.
31

32 13. The video player synchronizer of claim 10 wherein the first
33 and the second video player have drive means for creating relative scan-
34 ning motion between the video storage medium and a transducer under
35 the control of a first and a second servo signal, respectively, and where-
36 in the play synchronization circuit of the synchronizer further comprises:

1 (a) a first subtracter having one input connected to the output of
2 the first flop-flop, another input to be connected to the
3 first video player for inputting the first servo signal, and
4 an output to be connected to the drive means of the first
5 video player; and

6 (b) a second subtracter having one input connected to the output of
7 the second flip-flop, another input to be connected to the
8 second video player for inputting the second servo signal,
9 and an output to be connected to the drive means of the
10 second video player.

11
12 14. The video player synchronizer of claim 10 wherein the play
13 synchronization circuit further comprises:

14 (a) a first logic circuit having inputs connected to the first and the
15 second flip-flop for passing all output pulses thereof;

16 (b) a second logic circuit having inputs connected to the first flip-
17 flop and the first logic circuit for producing a pulse when
18 an inversion of the output from the first flip-flop is of
19 the same binary state as the output from the first logic
20 circuit; and

21 (c) a third logic circuit having inputs connected to the second flip-
22 flop and the first logic circuit for producing a pulse when
23 an inversion of the output from the second flip-flop is of
24 the same binary state as the output from the first logic
25 circuit.

26
27 15. The video player synchronizer of claim 14 wherein the ref-
28 erence moment determination circuit comprises a fourth logic circuit having
29 inputs connected respectively to the first and the second flip-flop of the
30 play synchronization circuit, and an output connected to the reset input
31 of the first and the second flip-flop of the play synchronization circuit,
32 for resetting the first and the second flip-flops upon simultaneous produc-
33 tion of pulses by the first and the second flip-flops.

34
35 16. The video player synchronizer of claim 14 wherein the first
36 and the second video player have drive means for creating relative scan-

1 ning motion between the video storage medium and a transducer under
2 the control of a first and a second servo signal, respectively, and where-
3 in the play synchronization circuit of the synchronizer further comprises:

4 (a) a first adder having one input connected to the second logic cir-
5 cuit, another input to be connected to the first video
6 player for inputting the first servo signal, and an output
7 to be connected to the drive means of the first video
8 player; and

9 (b) a second adder having one input connected to the third logic
10 circuit, another input to be connected to the second video
11 player for inputting the second servo signal, and an output
12 to be connected to the drive means of the second video
13 player.

14
15 17. A synchronizer for compulsorily synchronizing a first, a
16 second and a third video player for simultaneous display of correlated
17 pictures, each video player being for use with a video storage medium
18 on which there is stored a video signal including a series of vertical
19 sync pulses, the synchronizer comprising:

20 (a) a first vertical sync pulse separator circuit to be connected to a
21 first video player for separating a first series of vertical
22 sync pulses from a first video signal being recovered from
23 a first video storage medium;

24 (b) a second vertical sync pulse separator circuit to be connected to
25 a the second video player for separating a second series of
26 vertical sync pulses from a second video signal being re-
27 covered from a second video storage medium;

28 (c) a third vertical sync pulse separator circuit to be connected to a
29 third video player for separating a third series of vertical
30 sync pulses from a third video signal being recovered from
31 a third video storage medium;

32 (d) a reference moment determination circuit connected to the first
33 and the second and the third vertical sync pulse separator
34 circuit for determination of a reference moment in pre-
35 scribed time relationship to each vertical sync pulse of a
36 selected one of the first and the second and the third ser-

ies of such pulses being supplied from the first and the second and the third vertical sync pulse separator circuit; and

(e) a play synchronization circuit comprising a first and a second and a third *D* flip-flop having clock inputs connected respectively to the first and the second and the third vertical sync pulse separator circuit, reset inputs connected to the reference moment determination circuit, and data inputs connected to a supply terminal, for production of a first phase departure signal indicative of a phase departure, if any, of each vertical sync pulse of the first series from the reference moment determined in relation to one associated vertical sync pulse of the selected series, a second phase departure signal indicative of a phase departure, if any, of each vertical sync pulse of the second series from the reference moment determined in relation to one associated vertical sync pulse of the selected series, and a third phase departure signal indicative of a phase departure, if any, of each vertical sync pulse of the third series from the reference moment determined in relation to one associated vertical sync pulse of the selected series, the first and the second and the third phase departure signal being for delivery to the first and the second and the third video player, respectively, for causing the same to synchronize the first and the second and the third series of vertical sync pulses.

18. The video player synchronizer of claim 17 wherein the play synchronization circuit further comprises:

- (a) a first logic circuit having inputs connected to the first and the second and the third flip-flop for passing all output pulses thereof;
- (b) a second logic circuit having inputs connected to the first flip-flop and the first logic circuit for producing a pulse when an inversion of the output from the first flip-flop is of the same state as the output from the first logic circuit;

- 1 (c) a third logic circuit having inputs connected to the second flip-
2 flop and the first logic circuit for producing a pulse when
3 an inversion of the output from the second flip-flop is of
4 the same binary state as the output from the first logic
5 circuit; and
6 (d) a fourth logic circuit having inputs connected to the third flip-
7 flop and the first logic circuit for producing a pulse when
8 an inversion of the output from the second flip-flop is of
9 the same binary state as the output from the first logic
10 circuit.

11
12 19. The video player synchronizer of claim 18 wherein the ref-
13 erence moment determination circuit comprises a fifth logic circuit having
14 inputs connected respectively to the first and the second and the third
15 flip-flop of the play synchronization circuit, and an output connected to
16 the reset input of the first and the second and the third flip-flop of
17 the play synchronization circuit, for resetting the first and the second
18 and the third flip-flop upon simultaneous production of pulses by the
19 first and the second and the third flip-flop.

20
21 20. The video player synchronizer of claim 18 wherein the first
22 and the second and the third video player have drive means for creating
23 relative scanning motion between the video storage medium and a trans-
24 ducer under the control of a first and a second and a third servo sig-
25 nal, respectively, and wherein the play synchronization circuit of the syn-
26 chronizer further comprises:

- 27 (a) a first adder having one input connected to the second logic cir-
28 cuit, another input to be connected to the first video
29 player for inputting the first servo signal, and an output
30 to be connected to the drive means of the first video
31 player;
32 (b) a second adder having one input connected to the third logic
33 circuit, another input to be connected to the second video
34 player for inputting the second servo signal, and an output
35 to be connected to the drive means of the second video
36 player; and

1 (c) a third adder having one input connected to the fourth logic cir-
2 cuit, another input to be connected to the third video
3 player for inputting the third servo signal, and an output
4 to be connected to the drive means of the third video
5 player.

6
7 21. The video player synchronizer of claim 17 wherein the first
8 and the second and the third video player have drive means for creating
9 relative scanning motion between the video storage medium and a trans-
10 ducer under the control of a first and a second and a third servo sig-
11 nal, respectively, and wherein the play synchronization circuit of the syn-
12 chronizer further comprises:

13 (a) a first subtracter having one input connected to the output of
14 the first flop-flop, another input to be connected to the
15 first video player for inputting the first servo signal, and
16 an output to be connected to the drive means of the first
17 video player;

18 (b) a second subtracter having one input connected to the output of
19 the second flip-flop, another input to be connected to the
20 second video player for inputting the second servo signal,
21 and an output to be connected to the drive means of the
22 second video player; and

23 (c) a third subtracter having one input connected to the output of
24 the third flop-flop, another input to be connected to the
25 third video player for inputting the third servo signal, and
26 an output to be connected to the drive means of the third
27 video player.

28
29 22. A video player system for synchronous display of a plurali-
30 ty of correlated pictures, comprising:

31 (a) a display;

32 (b) a plurality of video players for recovering from video storage
33 media a set of correlated video signals for joint visual pre-
34 sentation on the display, each video signal including a ser-
35 ies of vertical sync pulses;

36 (c) a plurality of vertical sync pulse separator circuits connected one

1 to each video player for separating the series of vertical
2 sync pulses from the video signals being recovered from
3 the video storage media;

4 (d) a reference moment determination circuit connected to the vertical
5 sync pulse separator circuits for determination of a refer-
6 ence moment in prescribed time relationship to each vertical
7 sync pulse of one selected series of such pulses being
8 supplied from one of the vertical sync pulse separator cir-
9 cuits;

10 (e) a play synchronization circuit connected to the vertical sync pulse
11 separator circuits and the reference moment determination
12 circuit for production of a plurality of phase departure
13 signals each indicative of a phase departure, if any, of
14 each vertical sync pulse of one series of such pulses from
15 the reference moment determined in relation to one associat-
16 ed vertical sync pulse of the selected series of such
17 pulses; and

18 (f) drive means in each video player for creating relative scanning
19 motion between a transducer and the video storage medium,
20 the drive means being connected to the play synchroniza-
21 tion circuit for reducing the phase departure of the verti-
22 cal sync pulse from the reference moment in response to
23 one phase departure signal from the play synchronization
24 circuit.

25
26 23. The video player system of claim 22 further comprising:

27 (a) a controller in each video player for providing a servo signal for
28 servo control of the drive means; and

29 (b) an adder having an input connected to the play synchronization
30 circuit and another input connected to the controller of
31 each video player for supplying an addition of one phase
32 departure signal and one servo signal to the drive means
33 of each video player.

34
35 24. The video player system of claim 22 further comprising:

36 (a) a controller in each video player for providing a servo signal for

1 servo control of the drive means; and

- 2 (b) a subtracter having an input connected to the play synchroniza-
3 tion circuit and another input connected to the controller
4 of each video player for supplying a difference of one
5 phase departure signal and one servo signal to the drive
6 means of each video player.

7
8 25. The video player system of claim 22 further comprising:

- 9 (a) a controller in each video player for providing a play command
10 for the video player; and
11 (b) a status judgment circuit connected between the controllers of all
12 the video players and the play synchronization circuit for
13 permitting the latter to synchronize the video players only
14 when all the video players are in play mode.

15
16 26. The video player system of claim 22 further comprising:

- 17 (a) a controller in each video player for providing a play command
18 for the video player; and
19 (b) means connected between the controllers of the video players
20 and the play synchronization circuit for permitting the lat-
21 ter to deliver the phase departure signals only to the
22 drive means of those video players which are in play mode.